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SUSTAINABLE CITY POLICY: ECONOMIC, ENVIRONMENTAL, TECHNOLOGICAL

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Abstract:

Environmental problems have become world-wide concern for economists, as is witnessed by the development of many theories and policies aiming to drive the economy towards a "sustainable economy". The problem becomes even greater if we speak about cities: as recognised in many studies, more than 80% of the world population lives in cities, where quality of life and environmental concerns undermine all advantages associated with agglomeration economies.

The vast experience in terms of theoretical and empirical substance which has been built up around the theme of "sustainable economy" has only partially helped to generate a framework for an "urban sustainable development": the city is in fact by definition an "artificat environment", where well established concepts of "environmental economics" (such as natural capital stock, natural environment) can hardly be transferred and applied, in the way they are theoretically formulated.

The first scope of the paper is to offer an analytical framework for "urban sustainable development" to present the main economic concepts that are hidden under this label. In particular, various "environments" co-exist in a city: the natural, the artifact and the social environment. Each of them generates positive and negative externalities for the city, since each of them represent "use advantages" and "use costs" for a city. If this is true, then it is a plausible assumption that the integration of these three "environments" has to be supported with specific intervention policies. The main aim of this paper is to highlight the possible intervention policies which may be developed to achieve a balanced "sustainable development".

Keywords: urban sustainabilities; public policies; market interventions; technology oriented strategies

1. Introduction

In the context of sustainable city policy it should be recognised that cities are not passive spatial units victimised by anonymous global environmental developments, but may play an active role in producing sustainable development in a multiplicity of relevant fields, such as housing, employment or environmental quality. This promising profile of the city as a window of environmental opportunities is increasingly coming to the fore in institutional agenda formation for sustainable development, not only for the developed world but also for the developing world. This means that urban development planning has to address a wide variety of issues

and objectives regarding the economy, the environment, the cultural heritage and the socio-economic distribution of costs and benefits. Clearly, there is not a uniform panacea for sustainable urban planning, as there are site-specific environmental, economic, political and socio-cultural conditions in all cities of our world. In addition, representation and participation of citizens and the business sector in all aspects of urban life are critical (cf. Healey and Williams, 1993), as a sustainable city has to be created by people themselves.

Strategies favouring sustainable city development may also be varied in nature, ranging from information campaigns to financial incentives or strict regulations. Such strategies, which may inter alia concern economic sectors, social groups or land use in the city, should of course be consistent with sustainability policies elsewhere (adjacent areas, or higher geographical levels) up to the level of global environmental policy-making. In view of the threats caused by spatial environmental spillovers to other areas - a phenomenon also witnessed by concepts like weak/strong sustainability or external/internal sustainability - a coordinated action is needed to prevent spatial imbalances in sustainability policy at all levels and in all regions of an interconnected spatial system.

It is thus clear that sustainable city policy requires a multi-faceted strategy, in which socio-economic interests are brought in harmony with environmental and cultural interests. Such ideas have already been advocated more than a decade ago by Lynch (1981) who claimed: "The good city is one in which the continuity of this complex ecology is maintained while progressive change is permitted" (p.116). Lynch suggests five dimensions for judging such an urban quality: vitality, sence, fit, access and control. It goes without saying that the empirical application of such principles will require much applied research on sustainability conditions in a variety of urban settings.

In this context, the position of Third World cities deserves more attention (see also Nijkamp, 1995). Cities in the developing world are often facing a serious struggle for continuity and survival on the basis of short-run economic interests. Even though it is widely recognised that favourable environmental quality conditions are a sine qua non for long-term sustainability, severe short-term survival behaviour prevents many cities from developing a co-evolutionary strategy in which economic interests are brought in harmony with the urban ecology. Poverty situations are apparently playing a more privileged role than the strive for environmental quality improvement.

Nevertheless, the dilemma between micro rationality and collective sustainability policy ought to be considered also from the opposite perspective. Low environmental quality (including poor sanitary conditions) generates a multiplicity of negative stimuli for human health, education and social welfare and is hence detrimental to the welfare position of the economically less privileged and at the end at odds with a sustainable urban habitat.

This observation justifies strict public environmental housing and health policies in Third World cities, as investments in these sectors will pay off in economic terms in the long run. In this respect, there is in the long term no conflict of interest between urban economic development and urban environmental sustainability.

The reasons for the increasing importance attached to urban environmental policies are manifold. An important background phenomenon is the recent recognition that more than 80% of the world population lives in cities, where quality of life and environmental concerns undermine many socio-economic advantages associated with urbanisation. Moreover, cities

represent the location of most production and consumption activities of modern economies, and hence are for this reason the largest consumers of energy and materials. To the same extent cities generate a significant share of global environmental pollution.

The importance attached to the local level of analysis and policy-making is conceivable and in recent publications a more thorough justification has been given for the necessity to develop sustainability policies at a local level. Given the role of cities as vehicles for economic growth, a significant share of environmental issues is generated in urban areas. Hence, it seems to be a promising departure to look at cities as focal points for analyses and policies regarding global environmental detriments, such as greenhouse gas emissions of carbon dioxide, nitrous oxide, methane, etc. Such emissions tend to be rather concentrated in the urban area, while they generate at the same time environmental problems at a global scale.

Recent years have witnessed an increasing concern on urban environmental questions, e.g. the Greenbook on the Urban Environemnt by the EC, the Report on Environmental Policies for Cities in the 1990s by the OECD, the STOA report on the Technological City for the European Parliament and the Report on Urban Air Pollution in Megacities of the World by UNEP and WHO.

Various new concepts for coping with urban environmental decay have been introduced in the meantime, such as the "green city", the "eco-city", the "liveable city", the "resourceful city", the "zero-emission city" or the "sustainable city". The importance attached to the local level of analysis and policy-making is conceivable and in recent publications a more thorough justification has been given for the necessity to develop sustainability policies at a local level. In the context of sustainable city concepts it has to be recognised that in most developed countries the majority of the people live in urban areas and than most value added is generated in urban-economic activity spaces. Consequently, also a significant share of all pollutants is generated in urban areas. Hence, it seems to be a promising departure to regard cities as focal points for analysis and policy regarding local and global environmental quality problems. Most of environmentally damaging emissions are caused by human activities (e.g. industry, consumption, transport, etc.) and, of course, not all of these are the result of our "urban way of living". But the specific lay-out and life style of cities or urban areas does generally and world-wide cause various types of unnecessary greenhouse gas emissions. Motorized transport is of course a major contributor to such emissions, but also related activities such as industrial activies, the built environment, waste management, (lack of) district heating or combined heat and power technologies may exert a significant influence.

While the reasons for advocating intensified environmental concerns at the urban level are more and more accepted and clear, the question how to overcome such concerns is still fraught with many difficulties. The aim of the present paper is to formulate some policy guidelines - based on economic principles - for a "sustainable city"; it is an ambitious aim, since a unique and operationally defined "recipe" is difficult to envisage. An urban policy for a sustainable city needs to take different (and contrasting) aspects and many conflicting interests into consideration, while many political, social and economic frictions need to be overcome.

In light of the previous background observations, the structure of the present paper is the following. A description of various aspects and concepts concerning sustainability issues at the urban level is given in Section 2. Section 3 then provides some considerations on possible technological, economic and environmental urban policies, by creating a typology of policy tools associated with different causes of urban decline. Section 4 provides some new - and

partly provocative - suggestions for specific urban sustainability policies; in particular it deals with the problem of urban sustainability indicators, measures, and critical threshold levels at which urban sustainability policies should be implemented. Some reflective remarks will conclude the paper.

2. Sustainable City as a New Concept

2.1. The interaction between three critical environments

The definition of "sustainability" is still ambiguous; it has provoked many debates and many interpretations have been given to this concept (see Van den Bergh, 1991; Van Pelt et al., 1995 and Van Pelt, 1993). It is not the aim of this paper to enter this (never ending) semantic debate. However, the importance of the sustainability concept for the purpose of this paper is quite evident.

The vast literature on the concept of sustainability at a global scale contains, however, some common agreements on various critical aspects, namely:

- sustainability does not only refer to environmental protection, but embraces also economic and social aspects. As the well-known Brundtland report "Our Common Future" (1987) states: "... a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional changes are made consistent with future as well as present needs" (p. 46). This implies that the environmental utilisation space has to be related to social and economic factors;
- sustainability relates to a dynamic, balanced and adaptive evolutionary process, i.e., a process in which a balanced use and management of the natural environmental basis of economic development is ensured (Nijkamp and Perrels, 1994). A basic underlying principle may take for granted that the stock of natural resources should not be depleted beyond its regenerative capacity, a principle according to which sustainability is traditionally interpreted (see Opschoor and Turner, 1994; Pearce et al., 1989). This implies essentially a dynamic carrying capacity.

Our definition takes these two aspects as a starting point for the interpretation of what is meant by "urban sustainability". Clearly, first an effort to relate them to an urban setting is needed.

A city is in fact by definition an artifact environment, where the natural environmental aspects have already been sacrified to the creation of urban agglomerations. Consequently, it is a serious question to describe what is meant by a "sustainable city". Especially, the more diffused and common interpretation of a sustainable city as a city in which "natural environmental aspects" are given first priority in urban policy is somehow a limited interpretation, since it would underestimate, or even forget, the positive aspects related to the agglomeration advantages (synergy) in the city. These positive aspects stem primarily from the social and economic environments of a city and provide an explanation for the existence of this efficient and intricate organisation of space and time for all human activities over the last centuries. We will take our orientation in Haughton and Hunter (1994) who describe a sustainable city as "one in which its people and businesses continuously endeavour to improve their natural, built and cultural environments at neighbourhood and regional levels, whilst working in two ways which always support the goal of global sustainable development" (p. 27). Their definition means that the concept of a sustainable city is a multidimensional one and also related to higher geographical levels. On the other hand, emphasising the outcome of the use of local resources, both for consumption and for production purposes, viz. the level of

welfare or per-capita income, we could state that urban sustainable development (USD) is "a development which ensures that the local population can attain and maintain an acceptable and non-declining level of welfare, without jeopardizing the opportunities of people in adjacent areas" (Nijkamp and Opschoor, 1995).

In a city three different environments coexist, the physical (natural and built) environment, the economic environment and the social environment, each of them explaining in part or in combination the existence and continuity of a city. All three environments generate advantages and disadvantages for the city, i.e. user benefits and costs of a city. All three have to be considered together, because they deeply interact with one another and represent or express at the same time goals, means and constraints to human action in the city.

The economic environment justifies the presence of a city through the agglomeration economies concept, i.e. through the exploitation of specific socio-economic advantages due to spatial proximity, namely (Camagni, 1992 and 1994a):

- indivisibilities, in the provision of public goods, in the size of the urban market for outputs, for inputs and for the labour market, and in the presence of managerial capabilities and specialised functions;
- synergies, in the information exchange and face-to-face contacts, in the transfer of tacit information, in imitations in business behaviour, and in supplier-customer relationships.

All these elements have an impact on costs and revenues of economic actors, in particular reduction in production costs, reduction in transaction costs, increase in the efficiency of production resources, valorisation of production, reduction of uncertainty, and so forth.

The second dimension which may be introduced in the analysis of the city is given by the advantages stemming from the "social environment". This environment provides opportunities for individuals to exploit "social network externalities" (Capello, 1994): a city offers many social amenity resources, and guarantees socialisation opportunities and access to many public goods.

The third environment in a city is the "natural/built environment" or "physical environment". Advantages stemming from this environment are typical public goods and externalities, such as presence of urban green areas and environmental facilities, clear air, a pleasant city form, conducive to social interaction and peaceful living.

These notions are brought together in table 1. In our opinion, the concept of urban sustainability refers logically to the three above mentioned environments in a twofold way:

a. in a static sense, as maximisation of the net cross-externality effects of each of the three environments on the other two. both in a short and a long term perspective; this means avoiding to the largest possible extent the negative interactions and trade-offs and exploiting all the potentials for positive feedback effects;
b. in a dynamic sense, as co-evolution of the three environments in a balanced perspective.

We will first in turn analyse these two logical dimensions.

Table 1. Positive and negative external effects of the interaction between the different environments in a city

	Interaction between economic and physical environments	Interaction between economic and social environments	Interaction between social and physical environments
Positive external effects	Efficient energy use Efficient use of non-renewable natural resources Economies of scale in the use of urban environmental amenities	Accessibility to qualified housing facilities Accessibility to qualified jobs Accessibility to social amenities Accessibility to social contacts Accessibility to education facilities Accessibility to health services Diversification of options	Green areas for social amenities Residential facilities in green areas Accessibility to urban environmental amenities
Negative external effects	Depletion of natural resources Intensive energy use Water pollution Depletion of green areas Traffic congestion Noise	Forced suburbanisation due to high urban rents Social frictions on the labour market New poverties	Urban health problems Depletion of historical buildings Loss in cultural heritage

2.1.1. The static interaction

The interaction between the economic and the physical environment in a city is usually characterised by negative externalities. The negative effects generated by economic activity within the city on the natural/built environment are in fact well known and can be identified as environmental disasters caused by cities; depletion of natural resources, noise, water and air pollution, depletion of green areas, traffic congestion and intensive energy use are all negative external effects caused by excessive economic activities in cities. Given the role of cities as vehicles for economic growth, they are recognised to be the place where an intensive use of environmental detriments, as such greenhouse gas emission of carbon dioxide, nitrous oxide or methane, is rather concentrated.

On the other hand, we have to recognise that many of these negative effects are highly visible as a consequence of a mass effect and a density effect: if the same mass of economic activity were to take place in a more diffused territorial pattern, the spatial concentration of emissions could be reduced, but the absolute consumption of some natural resources (namely energy and soil) would be strongly increased. In other words, concentration of activities and proximity is not only a precondition for social interaction and economic efficiency, but also it is the source, up to certain levels, of increasing returns in the use of scarce, non renewable resources.

An example may be interesting in this respect. It is illustrative that the Milan metropolitan area, with 44% of the Lombardy population, accounts for 33% of regional energy for public lighting, 38% of electricity for domestic users, and 31.8% of electricity for all uses. Thanks to proximity and indivisibilities in energy consumption, the city may thus become an efficient user of natural resources.

The usual paradox is however, that because of the mass density of environmental externalities in city areas urban inhabitants are tempted to move out of the city, with the necessary consequence that individually their level of well-being may rise, so that at an aggregate level in a broader territorial setting the volume of environmental pollution will rise due to lower scale advantages and trasportation. This is a clear example of the well-known social dilemma.

The interaction between the economic and social environments gives rise to specific positive and negative external effects. The positive effects stem from accessibility to social services, such as education, health, social amenities (theatres and cinemas) and qualified jobs. On the contrary, agglomeration diseconomies may cause negative external effects on the social environment by imposing, for example, suburbanisation due to high urban rents, class segregation, new poverties and inertia in social class division. Social negative externalities may influence in a negative way the economic sphere, by generating various frictions on the labour markets, urban conflict, repulsion of potentially incoming firms.

The last interaction deals with advantages and disadvantages stemming from the physical and social environments. Various examples can also be given in this respect; green areas for social amenities are environmental resources which have a positive impact on social welfare. On the negative side, depletion of historical buildings, loss of cultural heritage or urban health problems are examples of negative effects of the physical environment on the social one.

A "sustainable city" is - in light of the above observations - now first of all a city where the three environments characterising an urban agglomeration interact in such a way that the sum of all positive externalities stemming from the interaction of the three environments is larger than the sum of the negative external effects caused by the interaction. A "sustainable city" is a city in which agglomeration economies should possibly be associated with positive environmental externalities and social network externalities, and in which at the same time negative effects stemming from the interaction of the three different environments should be kept within certain threshold conditions associated with the urban carrying capacity on the urban environmental utilisation space (Nijkamp and Opschoor, 1995).

2.1.2. The dynamic interaction

It is often stated that sustainability means a balanced co-evolution of the three environments that constitute the deep structure of society (and of the city). But it is still an open problem how this co-evolution may take place, in a spontaneous or planned way. Ethics, equity, regulations, market incentives are considered alternatively as elements that have to be included into the picture in order to ensure a true sustainability for economic development.

In our opinion, the condition under which such a co-evolution can actually be reached is a transformation and an integration of the regulatory principles governing the three environments (see figure 1). The pure short-term market profitability regulating the economic sphere cannot be sustained, in the presence of environmental externalities and in the absence of market signals referring to future markets and future generations; the same holds with respect to pure equity and welfare policies, or to pure ecological ad aesthetic regulations, which do not account for government failures, economic disincentives and high opportunity costs of intervention policies. A further shortcoming of pure or extreme eco-policies may also be found in equity considerations, in that it may easily happen that these policies bring only benefits to a part of total society, the one that could afford paying for easier access to environmental assets (or

paying more pollution rights); affluent classes in the case of households, and firms acting in monopolistic or oligopolistic sectors in the case of economic activities.

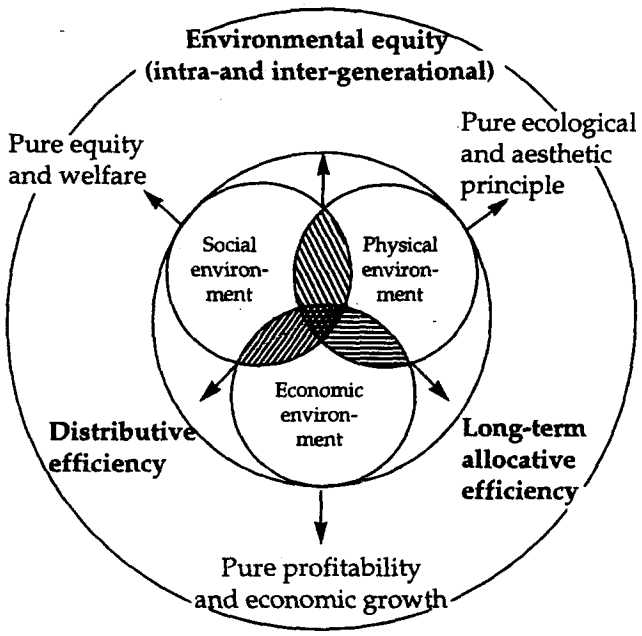

Fig. 1: The locus of sustainability principles and policies

Pure short term profitability principles should evolve into a long term allocative efficiency, through the internalisation of negative externalities, the embedding of certain behavioural rules with respect to the environment into common business practices, and the adoption of a long term perspective in the allocation of resources and in the definition of benefits and costs. The resort to market principles is maintained as the most effective way of allocating resources; but this market is enriched in order to take into account - through subsidies, taxes and some regulations - the cases where a pure market fails or does not exist or does not operate on a sufficient time horizon. The direction is towards the construction of what philosophers and theorists of justice call the "good-market", incorporating environmental considerations in the same way as present labour market incorporates modern working and wage conditions.

On the side of the integration between the principles regulating the environmental and the social sphere, an environmental equity principle should be developed, guaranteeing both inter- and intra-generational fairness. While the former is generally underlined in many current environmental debates, opening the way to a risk of inter-generational paternalism, the latter looks particularly crucial, in that not just provision of environmental assets should be secured, but also the fair social accessibility to these assets. In the absence of this, environmental policy could become the public provision of luxury goods. Equity in terms of income distribution is quite a different matter; here we draw attention to the substantial inequalities in access to e.g., land, water, energy, environmental and sanitation facilities. In Third World cities this problem is not related only to social services, but also to the basic urban environmental services, such as clean drinking water, sanitary facilities and solid waste collection (see Table 2); the degree to which these services are available in all cities and all parts of the cities should be driven by environmental equity. This is especially true for the poorer segments of the population in Third

World cities. Urban sustainability policies should address these differences in resource endowment by either enhancing the level of supply of public facilities (e.g. water, electricity, housing, sanitation) or by defining and (more equitably) allocating private property rights to environmental assets (Nijkamp and Opschoor, 1995).

Table 2. Incidence of Access to Basic Social Services in Four Asian Megacities

	Manila	Jakarta	Calcutta	Madras
Total Population (Millions of people)	6.4	8	9.2	5
Areas (square kilometers)	646	550	800	1170
Urban Density (People per hectare)	98	200	115	43
Urban Growth Rate (per cent)	3.8	4	3	3.5
Average Household Size (number of people)	5.4	5	5.1	5.2
Average Annual Income (US$ per capita per year)	296	132	104	104
Absolute Poverty Level (US$ per capita per year)	266	124	132	132
Percentage of Population below Absolute Poverty Level	35	60	60	45
Percentage of Population in Substandard Housing (slums)	45	40	33	60
Percentage Living in Squatter of Illegal Settlement	30	n.a.	n.a.	n.a.
Education Levels (literacy rates)	85	78	65	66
Percentage of Labour orce in the Informal Sector	50	65	54	60
Percentage with Access to Water (house connection)	43	47	48	40
Percentage of Garbage Collected Daily	70	25	55	78
Percentage with Access to Human Waste Disposal Systems	60	42	45	58

Note: although the data are drawn from the most authoritative and reliable sources, they may be not comparable because of the lack of standardised definitions and concepts used by different Countries in collecting the data.
Source: Lea and Courtney (1986), as quoted in Nijkamp (1995)

Finally, the integration between profitability and equity principles calls for a distributive efficiency: this means operating through redistributive mechanisms in order to secure social stability, fair access to education and health services, wider access to options of economic upgrading and vertical societal mobility. A sustainable city is not a city of equals, but requires a wide accessibility to those basic elements that allow the continuous regeneration of its professional basis and its creativity potential.

A city where distributive efficiency and environmental equity principles are established can be labeled a "good-city" in the tradition of some urban planners and urban scientists; as we

mentioned above, a "good city" is a city where the eco-dimension (both natural and built) is maintained, while progressive change is permitted (Lynch, 1981). But this is possible only when distributive efficiency as well as environmental equity principles are satisfied.

2.2. The global/local dilemma and the "locality theorem"

Cities, as the locus of modern economic and social relationships and the main concentrations of production activities and human interaction, are almost by nature the main producers of environmental pollution and therefore the natural focal points of reflections about development sustainability. The complicated issue they raise regards the global versus local nature of the environmental problems linked to them, and consequently the question of the most effective policy level at which these problems can be coped with.

Cities are by nature open systems, impacting intensively on other areas and on the earth as a whole. In fact, although a wide part of environmental problems originating from the internal operating mechanism of cities are felt at the local level (pollution, congestion, noise, decay of the visual environment), nevertheless many effects exist that have a transborder nature (e.g. waste water flows, waste disposal) or a global one (contribution of traffic and heating emissions to greenhouse effect and global warming).

From a policy point of view, the interlinkage of local/transborder/global problems originating from territorially limited units might present an advantage: that of operating locally with a global advantage. In fact, cities may be regarded as efficient starting points for sustainability policies, not just in the trivial sense of the size and spatial concentration of the problems they imply, but because:

- cities offer an institutional framework for coping with tailor-made local actions, particularly fitting with the diversified nature of sustainability issues (institutional efficiency);
- cities fit very well in the decentralisation movement in public policy, and are able to motivate more directly local actors like citizens and industries (subsidiarity);
- cities are also administrative units responsible for data collection, so that applied and policy-relevant research can more easily be undertaken at the urban level (monitoring and assessment efficiency).

But cities - and the local systems in general - may become efficient centres for sustainability policies as a consequence of another element stemming from the economics of environmental action, which may be depicted in the following terms: "the more local the problem (be it by nature, by convention or by policy-maker's choice) the more a sustainability policy can rely on (good-) market principles". In fact, with increasing "locality" we may generate the following beneficial impacts:

- increasing identity between polluter and victim, and therefore a higher willingness to avoid the damage or to pay for environmental protection;
- in cases of low number of polluters, it is easier to apply a polluter pay principle (also because the possibility of identifying them is higher);
- in the case of many polluters, population is more homogeneous, with more homogeneous goals and needs, and therefore polluters are likely to accept more easily to pay for environmental protection;
- property rights à la Coase could be more easily advocated and implemented in case of local commons than in case of global commons;
- it is easier to establish good-market rules reflecting local population ethics and goals, in order

to internalise externalities;
- some specific environmental goals may be achieved through the existing free market: some localised environmental assets may be seen as luxury goods, for whom some specific sub-communities might be eager to pay a price; given the positive externalities and transborder effects, the provision of these assets could be beneficial to a wider part of the local community (even if we cannot exclude an equity problem here);
- the smaller the territory under scrutiny, the higher transborder mobility of both population and economic activities. Therefore, local communities may be more eager to place a premium on environmental assets, in order to maintain or attract residential and economic activities;
- particularly in peri-urban sites, supra-national, national or local incentives to maintain a natural landscape and agriculture-related activities may be activated (as the ones guaranteed by the EU), in order to enhance the profitability of environment-friendly activities with respect to urbanisation or speculative expectations (Camagni, 1994b).

The "theorem" suggests that we should tackle urban environmental policies under a locality (or urban) viewpoint: an easier consensus can be obtained when local quality and congestion costs are under scrutiny, rather than when global greenhouse effects are prophesised. To the citizen, these latter are uncertain in terms of importance and causal chain, do not impact directly on their welfare function, and above are depending on parallel measures implemented independently and voluntarily by other communities. But even if substainability policies are implemented for the sake of local interests, they turn to be beneficial also at the global level.

3. Strategic Tools and Structural Features of an Urban Sustainability Policy

In designing urban sustainability policies, it should be recognised that our world turns to an urban world. Approximately eighty percent of the population of the EC lives in urban areas, while more than twenty percent lives in large cities of more than 250,000 inhabitants. This means that the "urban way of living" is the dominant form of "residential style". Industrial activities are to a large extent also concentrated in and around urban areas. And finally, by far the largest share of mobility flows takes place in urban areas as well. Consequently, cities (or, in general, urban areas) are to a large extent responsible for pollution emissions, including greenhouse gases such as carbon dioxide, nitrous oxide, methane, CFC's, etc. In the past decade, many efforts have been made to develop - with more or less success - sectoral environmental policies (e.g. concerning industrial manufacturing, household consumption, transportation), but so far the city - as a natural "niche" for energy/environmental management - has never been the subject of a comprehensive action-oriented sustainability strategy. This paper will now deal with the question how to design and assess policy strategies for turning cities as environmental problem areas into spatial entities of environmentally sustainable opportunities.

The time horizon of urban action-oriented sustainability policies is twofold; a short term and a long term horizon. The short term horizon interprets policy goals as the selection of production factor combinations, transport modes and behavioural patterns oriented towards a more careful control on urban environment; it allows a substitution for less environmentally sustainable activities, behaviours and production techniques with more environment-friendly ones. The second time horizon which can be envisaged is a long term horizon; in this case, sustainable city policies are oriented towards a structural change in activities, behaviours and technologies. While in the first case, the short term perspective, the idea is the substitution and selection of more sustainability-oriented urban actions, in the second case, the long term perspective, the logic driving policy goals is a logic of radical change and structural revision of choices related

to urban activities, urban forms and technology.

Two main fields of intervention policies may be envisaged for a city to drive it towards urban sustainability; technology and territory (see Table 3). The first and more common area of intervention is technology; a reduction in the use of less polluting technologies is one way of keeping environmental constraints under control, through less polluting transport means, less polluting heating systems, and in general through a more efficient energy use. Input substitution becomes in this way the short run aim of urban sustainability policy; through the substitution of more polluting and high energy consumption technology with more efficient ones, a certain level of production is guaranteed, with advantages in terms of better quality of the urban environment. On the other hand, many studies have developed the notion of "zero-emission city" and of "electrified urban areas", to underline the strategic role which technology may play in solving urban environmental problems. These notions are related to a long run technological policy, which may envisage a natural resources-benign technological change as a long term goal. In this perspective, a theoretical urban production function would not only present a different mix between less polluting factors and more polluting ones, but would guarantee higher production level with the same exploitation of energy and polluting inputs (see Table 3).

Table 3. Tools and Goals of Urban Sustainability Policies

FIELDS	TECHNOLOGY		TERRITORY	
tools and goals	Short run	Long run	Short run	Long run
MARKET-BASED TOOLS	Incentives to use less polluting transport means	Incentives to R&D for environmental-benign technologies	Incentives to reuse derelict areas	Incentives to supply environmental values in peri-urban areas
	Tax on energy resources		Pricing on scarce resources parking, road pricing)	Incentives for long distance transport means
	Discriminatory prices and taxes on energy		Incentives to provide and use technologies against congestions (traffic control systems)	Long distance transport means provision
	Marketable emission rights			
INSTITUTIONAL TOOLS	Discriminatory pricing in regulated services	Limits in the use of specific polluting technologies	Regulation for congested areas	Regulation for unused land
				Public transport provision
				Land development regulations
				Regulation for the use of certain materials
GOALS	Input substitution	Natual resources-being technological change	Change in mobility patterns and modal choice	Change in urban form

Intervention policies in this field are rather important, and should guarantee the achievement of a long term allocative efficiency. A "good market" which would internalise in its price mechanisms negative externalities associated with urban economic activity and realised through both institutional and market-based measures, finds its a more profound rationale not just in the short term disincentive to polluting inputs and activities, but in the long-term orientation of technological efforts towards sustainability.

Technology may in fact be the way in which the interaction between the economic and physical environments in a city is controlled. Technological upgrading in terms of energy use in urban areas offers many opportunities to the economic sphere, guaranteeing the same (or even more efficient) production system; at the same time it allows the economic system to control the negative external effects that its activities generate on the natural environment. This field of action strengthens the positive external effects associated with the interaction of the two environments - such as efficient energy use, efficient use of non-renewable natural resources - and keeps the negative external effects under control. Water pollution, air pollution, traffic congestion and depletion of natural resources may be improved with the introduction of technological-benign production systems.

To achieve these goals at an urban level, a series of market-based tools exist which may drive urban actors towards the use of less polluting technologies; incentives, taxes and discriminatory prices on energy are all examples of market mechanisms driving the urban system towards the exploitation of less polluting technological systems. Institutional regulations, through discriminatory pricing in regulated services and limits in the use of specific polluting technologies, help in this direction.

Technology does not represent the only field where urban sustainability policies should act. In the past few years, several attempts have been undertaken in different countries to identify optimal structures of urban form that would minimise energy consumption and environmental pollution. The territorial form of an urban system, in fact, and the organisation of its activities in space, is a second field of intervention which may lead towards urban sustainability. An example of this is the compact city idea, which contains the idea to minimise travel mobility patterns and thus energy use. A systematic identification and analysis of alternative urban configurations from the viewpoint of sustainable development and a critical judgement of such options seem necessary, as an uncritical implementation of common wisdom (like the compact city movement) does not necessarily lead to more environmental-friendly outcomes (Breheny, 1992).

Parallel to what happens with regard to the technological field, also in the field of territorial organisation we can separate short-term and long-term "visions" and strategies. In the short run the aim of urban sustainability policies is addressed towards a change in mobility patterns and modal choice. The shift from private cars to less polluting transport means may be achieved via institutional tools such as regulations in congested areas (i.e. traffic restrictions in core areas of the town) so as to influence travel behaviour. This is made possible through incentives and prices on scarce resources and through strict infrastructure regulations (see Table 3).

In the long run, a change in urban form may become the goal of urban sustainability policy; this implies not only a change in mobility patterns of urban residents, but also a change in urban locations and land-use patterns. It is recognised that environmental interests are usually not incorporated in regional and urban development planning, especially in Third World cities,

and normative guidelines - based, for example, on carrying capacity and regenerative capacity - are often absent from the planning process (Nijkamp, 1995). An effort in this direction is for sure a good strategy towards urban sustainability: it is a strategy which guarantees the same urban performance - in terms of activity levels - by reducing pressure on the carrying capacity of the urban environment. As is the case for technological change, also territory could be exploited in a way that the spatial allocation of urban activities minimises energy consumption and pollution emissions without limiting economic activities.

Territory is a field of action where urban sustainability policies may act on the interaction between the physical and the social environments. A different urban form, favouring urban sustainability, strengthens the positive external effects associated with the interaction of the physical and social environments, granting green areas for social amenities, better residential facilities, and higher accessibility to urban environmental amenities.

Finally, a third and less clearly identified field of possible policy interventions is personal "life-styles"; also in this area urban sustainability policies may play a role, although one can immediately foresee a much more limited space for these kinds of policies, since they impact directly on the private sphere and on behavioural choices of individuals.

In advanced countries the present life-style is the result of increasing per-capita income, and energy prices that do not include the full social costs of energy use. The number of private car ownerships is high and increasing, as well as the density of electrical appliances per family. High mobility in leisure time is also something which belongs to common social behaviour in modern societies. All these habits may be influenced by urban sustainability policies, such as differentiated price of electric energy by hours of the day, so as to influence energy use for private needs in peak hours. If these are short term policies, long term ones should try to orient structural changes in social behaviour embedding more environmentally-oriented attitudes.

In Third World cities, on the contrary, low per-capita income and high social-class disparities determine a different life-style, more oriented towards daily survival, justified by the high incidence of urban poverty (see Table 4). In Third World cities, life-style may be influenced by a wider access to basic social services, such as education, health and sanitary infrastructures. All these services allow people to change their habits, to raise their standard of living and to avoid environmentally damaging social behaviour (Button, 1992).

Table 4. Incidence of Urban Poverty in Developing Countries

Region	Urban Population (million)	Share of Each Region (per cent)	Urban Population below Poverty Line (million)	Share of Each Region (per cent)	Urban Population below Poverty Line by Region (per cent)
Africa	133.24	11.2	55.46	17	41.6
Asia	591.91	49.7	136.53	42	23
EMENA*	174.14	4.7	59.53	18	34.2
Latin America	291.66	24.5	77.27	24	26.5
Total	1191.95	100	329.79	100	27.7

* Europe, Middle East and North Africa

Source: World Bank 1989, as cited in Asian Development Bank 1991

In these three fields, and especially in the technology and territory field, there is ample space for urban sustainability policies, also in Third World cities. Although the fields of possible normative action are clear and evident, other problems related to urban sustainability policy remain open. In particular distributive and equity effects of the costs associated to specific urban sustainable policies remain an open question. This will be investigated in the next Section.

4. Market Principles for Urban Sustainability

Now the question emerges whether some market principles can be formulated which support the notion of a sustainable city. From what has been said before, some general points emerge as far as the urban sustainability paradigm is concerned, namely:

a. urban sustainability is an integrated concept, encompassing at the same time economic, physical (natural and built) and social aspects, and imposing a favourable (balanced) co-evolution of the three environments sketched in the "circles" of Figure 1;

b. a balanced co-evolutionary sustainable development path can be achieved by integrating the three logics or regulatory principles of each environment, still relying on (good-) market principles. By this we mean that the short term private profitability principle should be:
   - widened, so that also social costs and externalities may be taken into consideration (e.g. polluter pays principle) and a longer time horizon may be adopted by private decision makers (e.g. through incentives to R&D and long term technological change in the environmental sphere), and;
   - complemented by equity policies, in order to achieve a superior and long term effectiveness (what we have called "distributional efficiency") and to avoid the creation of new disparities and inequitable situations as far as the accessibility to (and the cost of) environmental assets is concerned);

c. urban sustainability policies should address the goal of enhancing the positive cross-interactions among the three environments, and avoid or limit the negative feed-back effects among them. In terms of the well-known trade-off between economic performance indicators and environmental quality indicators, all this means that policy intervention should aim at achieving an outward shift of this trade-off curve, at the minimum social cost.

As far as this last sentence is concerned, two reflections can be put forward. The first refers to the real form of the trade-off between the economy and the environment, since in different contexts characterised by widely different levels of per-capita income, this trade-off curve could turn into a positive slope (see figure 2). In fact:

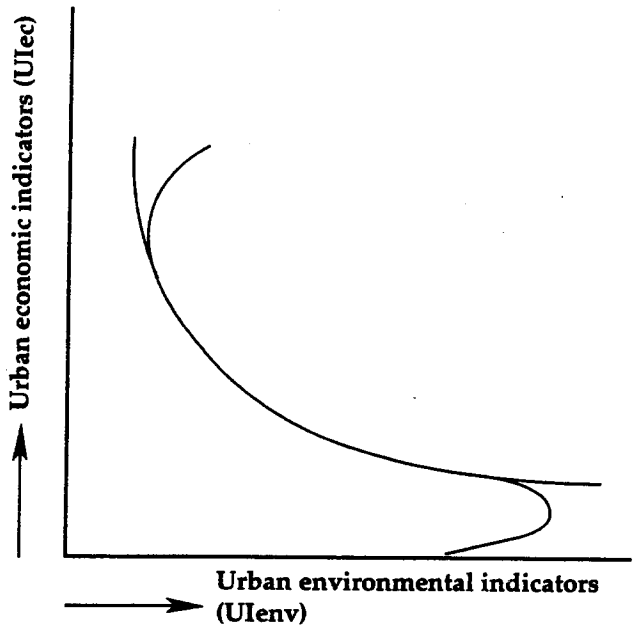

Fig. 2: The economic/environmental trade-off in widely different territorial contexts

- in Third World countries, an increase in income levels, carrying along better housing, basic social services and basic infrastructure conditions, improved general education levels and organisational capability, may (almost) automatically imply an improvement of environmental conditions. This is in line with what the South Commission (1990) claimed, when it stated that poverty causes environmental decay;
- on the other hand, in affluent and advanced societies, environmental quality may be felt by households as a crucially needed superior good, and by firms as a necessary location factor.

If these conditions are met, policy intervention could concentrate on only one goal, namely the economic one, by capitalising the positive spillovers (at least at the local scale) on the environmental side.

The second reflection regards the case where the trade-off curve between economic and environmental indicators maintains its traditional negative slope. In this case, a compatibility of economic efficiency principles (driven by growth objectives), social equity principles (driven by distributional objectives) and environmental equity principles (driven by ecological objectives) will normally require the identification of critical loads or thresholds for various relevant sustainability indicators at the urban level. This implies, for instance, that in the environmental field the total volume of permissible pollution in the urban area has to be assessed and specified, based on the concept of urban environmental utilisation space. Similarly, the mimimum acceptable level of economic performance (e.g. urban value added, urban employment) has to be indicated. Analogous targets on minimum distribution of resources (economic, environmental) may be set forth (e.g. by group, by urban district, etc.). This leads us to the notion of critical urban sustainability (CUS), which defines the feasible area within which urban sustainability would have to take place. Such a CUS would have to be based on measurable indicators, e.g.:

$$UI_{ec} \geq CUS_{ec}$$
$$UI_{env} \geq CUS_{env}$$

where UIec is the urban economic indicator and CUS_{ec} the critical urban economic sustainability indicator which has to be achieved in any case. Similarly, UIenv is the urban indicator for environmental quality and CUS_{env} the critical urban environmental threshold indicator, which should at least be attained. Clearly, for distributional impacts similar constraints may be imposed.

The basic question is now how the achievement of the above mentioned goals - in terms of a feasible solution space - can be realised. In economic terms, we have to investigate the trade-off between UIec and UIenv for instance, by using the following curve (see figure 3).

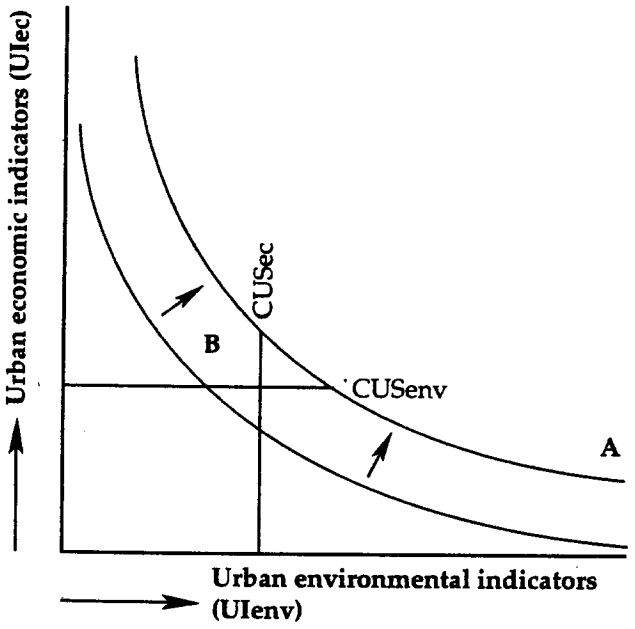

Fig. 3: The trade-off curve between UI_{ec} and UI_{env}

Normally, one would have to impose a cost curve to identify a least cost solution. The problem however is that in case of incompatibilities in critical threshold conditions (curve B) the maximum permissable environmental load has to be reduced to a level where sustainable development is guaranteed (curve B should shift to A). Here the solution strategies based on technology, territory and life-styles may be helpful, as discussed above. This leads to complicated choice problems regarding the question which sector in the urban area should be forced to reduce its pollution. A sector-specific re-allocation may be based on the principles:

- an equal percentage reduction of pollution in all sectors ("grand-fathering");
- a sector-specific reduction in pollution that is proportional to the environmental stress caused by that sector;
- a sector-specific reduction in pollution that is based on sectoral cost-effectiveness measures for pollution abatement;

- a sector-specific reduction in pollution that is proportional to the growth rate of its pollution in the past years;
- a sector-specific reduction in pollution that is inversely proportional to its pollution abatement investments in the past.

Institutional policy solutions (based e.g. on standards) do not seem to offer many perspectives for such trade-off problems, and therefore market-based tools may offer a much higher potential. Especially the idea of urban tradeable pollution permits seems to be promising here, as it will ensure that (Nijkamp and Vleugel, 1995):

- the overall urban critical environmental threshold is not violated;
- a cost minimising solution is found based on individual incentives for actors, and;
- transaction costs are included in the market based solution as well.

The tradeable permit policy ensures that not only environmental quality conditions but also distributional objectives can be achieved at minimum all-in costs. In fact, it allows a selective policy strategy with respect to different income groups or firms categories, whenever equity problems arise, acting on the initial distribution of pollution permits. Poor versus wealthy households, small versus large firms, competitive markets versus oligopolistic markets operating firms could receive special attention, according to the equity value judgement of the community. Urban sustainability policy would then mean a) to establish critical values for the urban economy the urban environment and the urban equity; b) to organise the market for tradeable permits by establishing rules for all actors involved and by creating the necessary institutional framework.

An application of tradeble emission permits for driving in the urban area is planned in Mexico City to increase the situation of air pollution due to heavy urban traffic (Goddard, 1995). An emission trading scheme is characterised by the following elements. In recognition that the benefits of many pollution control measures cannot yet be adequately quantified, the authorities take a cost-effectiveness approach to emissions control by fixing the area wide level of emission needed to meet the environmental air quality target or standard. Permits to emit are issued and distributed to emitters via one of several possible methods (based on equity principles), but the number of permits issued and distributed are insufficient to ratify past total emissions levels. As Goddard (1995) claims, in order to cover the gap between uncontrolled emissions and those that the permits would allow, the emitter has two options:

- implement emissions reductions, by installing and operating pollution control equipment (technological change towards more efficiently environmental technologies);
- buy permits from others, who then in turn will have to implement emissions reductions measures. A market can be organised by the local government for exchanging these pollution permits.

Emission targets will in this case be reached in a cost-effective manner, thus avoiding unnecessary expenditures to reach the air pollution target; most of the mechanisms in fact rely on market principles, which do not need a direct control of the government to make them work properly. Apparently, the equity principle is one possible objection to the introduction of such a control mechanism. However it can be taken into consideration, in the phase of distribution of tradeble permits; an equal distribution of these permits may be ensured by relying on income distribution.

5. Conclusions

The paper presents some reflections and propositions on urban sustainability policies, applied to both the case of advanced and Third World Cities. In synthesis, the main propositions presented in the paper are the following:

- the concept of "urban sustainability" is a complex concept which refers to the interaction of three critical environments which characterise an urban system: the physical, the economic and the social environments. This interaction generates positive and negative external effects;

- in a static perspective, a sustainable city is first of all a city where the three above mentioned environments interact in such a way that the sum of all positive externalities stemming from the interaction is greater than the sum of the negative external effects caused by the interaction;

- in a dynamic perspective, urban sustainability means a balanced co-evolution of the three environments that constitute the city. The condition under which such a co-evolution can actually be reached is a transformation and an integration of the regulatory principles governing the three environments. Firstly, pure short term profitability principles should evolve into a long term allocative efficiency, which guarantees a (good-)market incorporating the full social costs in the market prices. Secondly, an environmental equity principle should be developed, guaranteeing intra and inter-generational fairness. Thirdly, a distributive efficiency is called for, which requires operating through redistributive mechanisms in order to secure social stability, fair access to education and health services;

- three main fields of intervention policies for urban sustainability are envisaged: technology, territory and life-styles. For each of them, short-term and long-term measures may be foreseen. The former find their rationale in a substitution for less environmentally-sustainable activities, behaviours and techniques with more environment-friendly ones. The latter are oriented towards a structural change in activities, behaviours and selection of more sustainability-oriented urban actions;

- urban sustainability policies should address the goal of enhancing the positive cross-interactions among the three environments, and avoid or limit the negative feed-back effects among them. In terms of the well-known trade-off between economic performance indicators and environmental quality indicators, all this means that policy intervention should aim at achieving an outward shift of this trade-off curve, at the minimum social cost;

- at certain income level (i.e. at very low or very high income levels) the trade-off curve has a positive slope. In Third World countries, an increase in income levels, carrying along better housing, basic social services and basic infrastructure conditions, improved general education levels and organisational capability, may (almost) automatically imply an improvement of environmental conditions. On the other hand, in affluent and advanced societies, environmental quality may be felt by households as a crucially needed superior good, and by firms as a necessary location factor. If these conditions are met, policy intervention could concentrate on only one goal, namely the economic one, monitoring the positive spillovers (at least at the local scale) on the environmental side;

- in front of the traditional trade-off curve between urban environmental and economic indicators, the problem is that in case of incompatibilities in critical threshold conditions the

maximum permissable environmental load has to be reduced to a level where sustainable development is guaranteed. In this situation, the tradeable permit policy ensures that not only environmental quality conditions but also distributional objectives can be achieved at minimum all-in costs. In fact, it allows a selective policy strategy with respect to different income groups or firms categories, whenever equity problems arise, acting on the initial distribution of pollution permits. On the contrary, institutional policy solutions do not seem to offer many perspectives for such trade-off problems.

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